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Full Length Research Paper

Evaluation of antimicrobial property of *Ximenia americana*

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An investigation was carried out to determine the phytochemical composition and antimicrobial activity of ethanol and water extract originating from the powdered leaves, stem-bark and roots of *Ximenia americana*. Phytochemical analysis showed that the plant parts contained saponins, tannins, volatile oils, phenols, flavoniods, alkaloids, glycosides and resins. Only water extract do not contain glycosides. The antimicrobial activity tests of the plant extracts on *Escherichia coli*, *Staphylococcus aureus*, *Salmonella spp* and *Candida albicans* showed that ethanol extracts had inhibitory activity on *S. arueus* only. Water extract showed inhibitory activity on *E. coli* and *S. aureus* but did not inhibit the growth of *Candida albicans* and *Salmonella* spp.

Keywords: *Ximenia americana*, phytochemical composition, antimicrobial activity, alkaloids.

INTRODUCTION

Antimicrobial agents are substances that interfere with the growth and metabolism of microbes. In common usage the term denotes inhibition of growth and with reference to specific groups of organisms such terms as antibacterial, antifungal, antiviral and antiprotozoa are frequently employed. Antimicrobial agents may either kill microorganisms or inhibit their growth. These agents depend on the normal host defenses to kill or eliminate the pathogens after its growth has been inhibited. For example, sulfa drugs, which are frequently prescribed for urinary infections, inhibit the growth of bacteria in the bladder until they are eliminated during the normal process of urination. These antimicrobial agents are particular useful in situations in which the normal host defenses cannot be relied on to remove or destroy pathogens (Nester et al., 2004).

Medicinal plants are of great importance to the health of individuals and communities, plants have provided source of inspiration for novel drug compounds. Modern scientist have made phenomenal step in developing this heritage handed over by our forefathers (Sofowora,1986).

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In Nigeria, application of medicinal plants especially in traditional medicine is currently well acknowledged and established as a viable profession (Kafaru, 1994). Extraction of bioactive compounds from medicinal plants permits the demonstration of their physiological activity. It also facilitate pharmacology studies leading to synthesis of a more portend drugs with reduced toxicity (Ebana et al., 1991).

Presently in the developing countries, synthetic drugs are not only expensive and inadequate for the treatment of diseases but are also often with adulterations and side effects (Shariff, 2001). Therefore, there is need to search for suitable plants of medicinal value to be effectives in the treatment of diseases, which must be harmless to human tissue.

Medicinal plants represent a rich source from which antimicrobial agents may be obtained. Plants are used medicinally in different countries and are a source of many powerful drugs (Srivastava et al., 1996). The interest in the scientific investigation of medicinal plants from Nigeria is based on the claims of their effective use for the treatment of many diseases. Therefore research into the effects of these local medicinal plants is expected to enhance the use of these plants against diseases caused by the test pathogens.

The recent examination by the United Nations

Commission of Trade and Development (UNCTAD) indicated that about 33% of drugs produced in the developing counties are obtained from plants (UNCTAD/GATT 1974) and if microbes are added, 60% of medicinal plants are of natural origin (Sofowora, 1981). According to Sofowora sources, almost 80% of present day medicines are directly or indirectly derived from plants (Myers, 1982). Surprisingly this large quantity of modern drugs come from less than 15% of plants, which are known to have been investigated pharmacologically out of essential 250,000 to 500,000 species of higher plant growing on earth (Farasworth and Bingel, 1977).

Medicinal plants still remains the primary source of supply of many important drugs used in orthodox medicine today. One of such medicinal plants is *X. americana.* Investigation into the chemical and biological activities of plants during the past two centuries have yielded compounds for the development of modern synthetic organic chemistry and the emergence of medicinal chemistry as a major route for the discovery of novel and more effective therapeutic agents. The African continent is one which is endowed with one of the richest biodiversity in the world as abundance of many plants used as herbs, foods and for therapeutic purpose. Great need arises for the evaluation of the constituent pharmacological properties and detailed screening of bioactive substance for chemotherapeutic purpose. Furthermore, investigation into the antimicrobial activities of these plants will show that plants are potential sources of synthesis of drugs (Clark, 1996; Kubmarawa et al., 2009).

The active principles for many drugs found in plants are secondary metabolites (Ghani, 1990). Therefore, basic phytochemical investigation of these extracts for their major phytochemicals is also important. In the present study the ethanol and water extracts from *X. americana* plant parts were screened for phytochemicals constituents and antimicrobial activity against *E. coli, C. albicans, S. aureus, and Salmonella* Spp.

MATERIALS AND METHODS

Sampling and Sample Preparation

A fresh sample of the roots, stem-bark and leaves of *X. americana* were collected from Gombi Local Government Area in Adamawa State and were identified by Dr. D. A. Jauro of Forestry Department, School of Agriculture and Agricultural Technology, Modibbo Adama University of Technology, P.M.B. 2076, Yola, Nigeria. The leaves, stem- bark and the roots were air-dried under shade in the chemistry laboratory of the department. The dried plant materials were ground into fine powder using pestle and mortar. Each ground sample was weighed and then stored in a dry container at ambient temperature.

Table 1. Results of phytochemical analysis of ethanol extracts from roots, stem-bark and leaves of *X. americana.*

Bioactive Compounds	Stem-bark	Leaves	Roots
Saponins	+	+	+
Tannins	+	+	+
Flavonoids	+	+	+
Alkanoids	+	-	+
Volatile Oils	-	+	-
Phenols	+	+	+
Glycosides	+	+	+
Resins	+	+	+

Key: + = present; - = absent.

Extraction

120 g each of the powdered roots, stem-bark and leaves of the plant were percolated with 1.5 L of ethanol for three days. After which there was decantation, filtration and concentration on rotary evaporator model R110 at 40^{o}C to obtained ethanol soluble fractions. A portion of each was used for the phytochemical screening while the others were kept in the refrigerator for the antimicrobial test. The above procedure was repeated with 120 g each of the powdered roots, stem-bark and leaves of the plant with the use of 1.5 L of water.

Phytochemical screening

Phytochemical screening for major constituents was undertaken using standard qualitative methods as described by (Harborne, 1992), (Fadeyi et al., 1987), (Odebiyi and Sofowora, 1990) and (Abulude, 2007). Saponins, tannins, flavonoids, alkaloids, volatile oils, glycosides, resins and phenols tests were conducted in all the fractions. The results of the phytochemical screening for the ethanol and water extracts are shown in Tables 1 and 2 respectively.

Antimicrobial activity

Four microorganisms: *E. coli, C. albicans, S. aureus, and Salmonella* spp. were used for the antimicrobial screening. The stock cultures were collected from Specialist Hospital, Yola, Adamawa State. The stocks were maintained on nutrient agar slant and sub-culture in nutrient both for incubation at 37^{o}C prior to each antimicrobial testing. The discs were prepared using a Whatman filter paper No 1 and putting in vials-bottles and sterilizing in an oven at 150^{o}C for 15 minutes. Prepared discs containing the various extracts were carefully placed on the plates containing specific organism using a sterilized forceps in each case (Fatope, 1983). After incubation, the inoculated plates were observed for zones of inhibition (in mm diameter). The result was taken by considering the zone of growth and inhibition of the organisms by the test fractions (Mackie and McCartney, 1989). Results are shown in Tables 3 and 4 for ethanol and water extracts respectively.

Table 2. Results of phytochemical analysis of water extracts from roots, stem-bark, and leaves of *X. americana*.

Bioactive compounds	Stem-bark	Leaves	Roots
Saponins	+	+	+
Tannins	+	+	+
Flavonoids	+	+	+
Alkanoids	+	-	-
Volatile oils	-	+	-
Phenols	+	+	+
Glycosides	-	-	-
Resins	+	+	+

Key: + = present; - = absent.

Table 3. Results of antimicrobial efficacy of ethanol extracts from roots, stem-bark, and leaves of *X. americana.*

Microorganisms	Diameter of zone of inhibition (mm)		
	Leaves	Stem-bark	Roots
E. coli	R	R	R
S. aureus	8±0.2	12±0.3	10±0.2
C. albicans	R	R	R
Salmonella spp.	R	R	R

Key: R = Resistance; Values are mean of three trials ± Standard error.

Table 4. Results of antimicrobial efficacy of water extracts from roots, stem-bark, and leaves of *X. americana.*

Microorganisms	Diameter of zone of inhibition (mm)		
	Leaves	Stem-bark	Roots
E. coli	10±0.1	13±0.2	15±0.2
S. aureus	9±0.2	11±0.3	12±0.2
C. albicans	R	R	R
Salmonella spp.	R	R	R

Key: R = resistance; Values are mean of three trials ± Standard error.

RESULTS AND DISCUSSION

The results of the phytochemical screening of the extracts are shown in Tables 1 and 2 for ethanol and water respectively. Antimicrobial activities of extracts are shown in Table 3 and 4 for ethanol and water respectively. In Table 1, saponins, tannins, flavonoids, glycosides, phenols and resins were present in all the plant parts extracts, while alkaloids were only present in stem-bark and roots; Volatile oils were present in the leaves only.

Table 2 shows that saponin, tannins, flavonoids, resins, phenols were present in all the extracts. Alkaloids were present only in the stem-bark; volatile oils were present in the leaves. Glycosides were completely absent in the water extracts.

Ethanol extracts in Table 3 shows inhibitory activity on *S. aureus*. Whereas no inhibitory activity on *E. coli, C. albicans* and *Salmonella* spp. Water extract in Table 4 shows inhibitory activity on *S. aureus* and *E. coli.* Whereas it showed no inhibitory activity on *C. albicans* and *Salmonella* spp. However, these confirmed the local use of the plant in treatment of some ailments as reported elsewhere.

Conclusion

From the results obtained for the phytochemical screening of three different plant parts using ethanol and water as solvent showed that tannins, saponnins, flavoniods, phenols and volatile oils were present but glycoside was totally absent in the water extracts.

Ethanol extracts of the plant parts were found to have antimicrobial activity on *S. aureus*. It was also found that the water extract showed antimicrobial activity on *S. aureus* and *E. coli*. The inhibitory activity of the extracts confirmed the potential use of the plant in treatment of microbial induced ailments. Hence the plant extracts could be a source of drug useful in the chemotherapy of some microbial infections.

REFERENCES

Abulude FO (2007). Phytochemical Screening and Mineral Contents of Leaves of some Nigerian Woody Plants. Res. J. Phytochem. 1(1):33-39.

Clark AM (1996). Natural products as a resource for new drugs. Pharm. Res. 13(8):1133-1144.

Ebana RUB, Madunagu BE, Ekpe ED, Otung IN (1991). Microbiological Exploitation of Cardiac glycosides and alkaloids from *Garcinia kola, Barreria ocymoides, kola nitida* and C*itrus aurantifolia.* J. Appl. Biotechnol. 71: 398-401.

Fadeyi MO, Adeoye AO, Olowokudejo ID (1987). Epidermal and phytochemical studies with genus of *Bohervia* (Nyctanginaceae) in Nigeria. Int. J. Crude Drug Res., 27: 178-184.

Farasworth NR, Bingel AS (1977). Problems and prospects of discovering new drugs from higher plants by pharmacological screening. In Medicinal Plants and Traditional Medicine in Africa*.* Sofowora, A (Ed). John Willey and Sons Ltd. New York. pp.128-161.

Fatope MO, Adoum OA (1983). Bioactivity of some savannah plants in the brine shrimp lethality test and in-vitro anti-microbial assays. Int. J. Pharmacognosy, 35(5): 334-337.

Ghani A (1990). Introduction to Pharmacognosy. Ahmadu Bello University Press, Ltd. Zaria, Nigeria. pp. 45-47, 187-197.

Harborne JB (1992). Phytochemical Methods. Chapman and Hall publication; London, UK. pp. 7-8.

Kubmarawa D, Khan ME, Mtswenem M, Uwemedimo A, Timi

PG, Hassan M, Atiko R (2009). The phytochemistry and chemotherapeutic effects of some African medicinal plants. J. Chem. Soc. Nigeria, 34(1): 58-63.
Kafaru E (1994). Immense Help from Nature's Workshop. Elika Health Services Ltd. Academic Press Plc. Lagos, Nigeria. pp. 1-27.
Mackie R, McCartney C (1989). Practical Microbiology 3rd edition, Vol. 2 Churchil Livingstone (publishers), London, UK. pp. 100-106, 121, 141, 163-167, 303, 432-491.
Myers N (1982). Readers Digest. Readers Digest Association - Inc. U.S.A, 121(723): 124-128.
Nester EW, Robert CE, Pearsall NN, Anderson DG, Nester MT (2004). Microbiology: A human perspective 4th Edition McGraw Hill Inc. pp. 507-508.
Odebiyi A, Sofowora A (1990). Phytochemical screening of nigerian medicinal plants. Part III. Lioydia 41: 234-246.
Sofowora A (1981). The State of Medicinal Plants Research in Nigeria. University of Ife, Press, Nigeria. pp. 1-2.
Sofowora A (1986). The State of Medicinal Plants Research in Nigeria, published by spectra books limited, Ibadan, pp. 1-11, 56, 65-70, 74, 87-89, 138, 24-251, 261-264, 360-362.
Srivastava J, Lambert J, Vietmeyer N (1996). Medicinal plants: An expanding role in development. World Bank Technical Paper, p. 320.
Shariff LU (2001). Modern herbal therapy for common ailments. Nature Pharmacy Series (Volume 1), Spectrum Books Limited, Ibadan, Nigeria in Association with Safan Books (Export) Limited, United Kingdom, pp. 9-84.
UNCTAD/GATT (1974). Markets for Selected Medicinal Plants and Derivatives. United Nations Conference on Trade and Development. Headquarters, Geneva, p. 72.